A CASE STUDY ON CONCRETE PROBLEMS IN UTM

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This study is especially dedicated to my beloved Mommy and Daddy

Brothers and Sisters,

Beloved *Dear*,

for everlasting love, care, and supports…..

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ABSTRACT

This Project was conducted to study the types of concrete problems and its basic category in UTM. The required information was gathered by conducting visual inspection to selected areas and buildings. Interviews with Pejabat Harta Bina and building custodian had made this survey easier when the required information available in their archive. By using fundamental knowledge in relating symptoms of defects to its causes, defects list and weightage of concrete problems based on percentage according to their basic category of cause i.e. Design Deficiency, Material Defect, Construction Error and Maintenance Defect, has been able to be developed and derived. The relationships were determined using approximate approach i.e. deducing initial failure hypotheses (IFH). From this survey, apparently based on the percentage, Design Deficiency has contributed the highest numbers of defective concrete in the survey, followed by Material Defect, Construction Error and Maintenance Defect, by, 34%, 30%, 26% and 10%, respectively. These data are further utilised by relating its causes to durability of the concrete structures in UTM. The results show that, regardless the root of reasons why concrete has became problematic; it has, for sure, given profound impact on the durability of concrete. For instance, crackings induced by design deficiency or by construction error at least permit access and ingress to aggressive agents to propagate deterioration process i.e. corrosion of reinforcement. With these information, it is hoped that the established platform on gathered information about concrete problems in UTM, may able to set forth preliminary reference for any purposes in relating to the above subject. Therefore, preventive measures can be set forth to avoid repetitive concrete problems in UTM in years to come.

ABSTRAK

Projek ini disediakan untuk mengkaji masalah konkrit dan kategorinya di UTM. Untuk mencapai objektif kajian, maklumat yang diperlukan diperolehi melalui kaedah pengamatan dan sesi-sesi temuramah dengan pihak-pihak yang berkaitan yang telah banyak membantu dalam penyiapan laporan projek ini. Dengan menggunakan pengetahuan asas dalam mengenal pasti simptom-simptom kegagalan konkrit dan penyebabnya, senarai masalah konkrit dan peratusan berbanding jumlah kegagalan berdasarkan kategori-kategori am iaitu *'kegagalan rekabentuk'*, *'kegagalan bahan'*, *'kesilapan pembinaan'* dan *'kelemahan kerja-kerja penyelenggaraan'*; telah dapat ditentukan dengan menggunakan kaedah hipotesis awal kegagalan. Berdasarkan kajian, kategori *'kegagalan rekabentuk'* telah menyumbangkan peratusan yang tertinggi berbanding kategori-kategori lain sebanyak 34% daripada keseluruhan data yang telah direkodkan. Ini diikuti dengan kategori *'kegagalan bahan'*, kategori *'kesilapan pembinaan'* dan kategori '*kelemahan kerja-kerja penyelenggaraan'* dengan peratusan masing-masing sebanyak 30%, 26% dan 10%. Data-data ini seterusnya dianalisa dengan mengkaitkannya dengan kebolehtahanlasakan konkrit di UTM. Data yang diperolehi menunjukkan, tanpa mengira kategori penyebab masalah, ia sudah pasti akan mempengaruhi kebolehtahanlasakan konkrit. Contohnya, keretakan yang disebabkan kegagalan pada rekabentuk dan teknik pembinaan yang salah akan memberikan ruang untuk agen-agen agresif menyebabkan proses kemerosotan kualiti konkrit terutamanya pengaratan pada tetulang konkrit. Dengan maklumat-maklumat ini, diharapkan ia dapat menyediakan satu platform pengumpulan masalah-masalah konkrit di UTM dan juga sebagai rujukan awal untuk tujuan berkaitan masalah tersebut. Oleh itu, langkah-langkah pencegahan dapat ditentukan supaya masalah-masalah konkrit di UTM tidak akan berulang di masa akan datang.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Introduction

With the advancement of concrete technology, concrete are formed in many ways and in enhanced quality. For instance, precast structures have become prominent in the contemporary construction industry, concrete are pre-prepared in the factory before placing it to the construction site area. Furthermore, nowadays, we can see so many ready mixed concrete suppliers, offering various type of concrete. It has become pleasant and a great helpful system especially when dealing with fast-track projects. Hence, with rapid growth of its use for structures skeleton or for aesthetic purpose, nobody can help from being surrounded by material named concrete; housing, bridges, dams, roads, offices and even pathways also made from concrete. Some says, it is like living in a concrete jungle era or concrete-age.

However, inevitably, numbers of records have shown that concrete has been experiencing problems in deterioration, cracks, spalling, corrosion and many more to quote here [1, 2, 3, 4]. These problems has become unfavourable and invited unpleasant feeling to the occupants. Seeing this, most of us take some form of acceptance when seeing problems in concrete. Wide variety of concrete problems may result in many bewildering impressions. Are they due to poor workmanship, were non-compliance materials used, construction errors or perhaps design errors? In fact, there are a lot more of reasons why concrete becomes problematic. Therefore, decisions to overcome concrete problems can be started using heuristics to deal with bounded rationality of such why the problem occurred in the first place. Systematic

errors can result in from use of an incorrect heuristic and the errors, for sure, will appear over and over since the rule used to make decision is flawed from the onset.

Henceforth, engineers may have to learn and understand the behaviour of the concrete problems before implying any repairing methods and learn from the successful implemented solutions done by others before this. Otherwise, time, money and efforts, will be wasted for using wrong implication and heuristic. Therefore, a research should be conducted to get the right implication and heuristic. Nobody should imply solution if there is lacking of complete information on the intended-for-research concrete. Hence, investigations may have to be carried out on certain parameters such as the proportion of the mix, criterions applied to calculate concrete mix, types of supervision during construction; were the materials inspected before use, were the concrete poured complying with the design mix, and many more approaches to get the right implication and heuristic.

Using the above philosophy, a research on concrete problems in UTM ought to be conducted in obtaining the right repairing methods or at least as a general reference tool before doing any construction works.

However, the research in this paper is not about repairing methods but merely a case study research on concrete problems related to durability; investigate and identify concrete problems including locations where they might be, and classify its symptoms to probable causes where in here appropriate preventive measures and repairing methods can be suggested. Still, it is not about repairing methods.

1.2 Research Background

As mentioned previously, concrete problems are so common and yet, there are numerous types of concrete problems that can be inserted in the list if any.

Noticeably, there are many types of concrete problems in UTM such as cracks, deteriorated and abraded concrete; probably due to chemical attack,

construction errors, design errors etc. This has brought the interest to conduct a research on type of concrete problems in the vicinity of Universiti Teknologi Malaysia, Skudai (UTM).

Having this in mind, it is a need that a research on concrete problems in UTM may have to proceed with limitation on its durability aspect due to the fact that concrete problems is an extremely complex subject. It differs from one to another due to different site attributes. Few examples of concrete problems in UTM are shown in Figure 1.1, Figure 1.2 and Figure 1.3:-

Figure 1.1: Figure depicts concrete have been severely eroded and start spalling.

Figure 1.2: Figure depicts pathways slab transversely cracking.

Figure 1.3: Figure depicts apron slab start cracking and surface is abraded.

1.3 Research Objectives

The objectives of the research can be short listed as follows:

(i) To conduct a study on concrete problems occurring in UTM.

(ii) To classify the concrete problems and its causes using *initial failure hypothesis* (IFH) method [5].

(iii) To relate the concrete problems in UTM to the durability aspect of concrete.

1.4 Scopes of Research

The scope of research shall be in line with the concrete problems in durability aspect. Its huge built area encompasses faculties' buildings, residential buildings, library, and facilities buildings such as sports complex, food courts, mosque, banks, student affairs buildings, and administration centre. These buildings and its surroundings shall be the areas where all the data will be sourced out.

During the process of gathering raw data, all types of problems will be recorded and illustrated. Screening and scrutinizing will be carried out to classify the problems prior getting into the main study that is durability problem of concrete, which will be discussed in the Chapter 4, where it presents a logical method for relating the symptoms or observations to the various causes.

In addition, the study is also intended to establish diagnoses on concrete problems in initial failure hypothesis form. The cause or causes for the deterioration of concrete, such as crack problems will be diagnosed and related to common problems that can occur anywhere, anytime in the field of construction site due to the lack of precautions or steps taken to ensure that the concrete was satisfactorily complied in accordance with the requirements of relevant standard.

Finally, all the interpreted and analyzed data will be tabulated in a table form, showing type of problems, weightage by numbers and percentage, and locations

where problems occurred. These data can be used to relate its symptoms to causes of the problem where it may suggest solutions and preventive measures to avoid repetitive problems in the future. In addition, it is hoped that the information from this study can be useful as a preliminary reference to construction players prior executing any construction works or repairing works in the future prospect of the Malaysian construction industry.

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